Generac Power Systems
S45W29290 WI-59
Waukesha, WI 53189

MPE Evaluation

The following MPE calculations were re-performed for the Sierra HL8710 (FCC ID N7NHL78A / IC: 2417C-HL78A) using the Taoglas PCS.66.A.

Power Density (S) is calculated by the following formula:

$S=(P*G)/4\pi R^2$

where:

S = power density (in appropriate units, e.g. mW/ cm^2)

P = power input to the antenna (in appropriate units, e.g., mW)

G = power gain of the antenna in the direction of interest relative to an isotropic radiator

π = 3.1416

R = distance to the center of radiation of the antenna (appropriate units, e.g., cm)

FCC Limits (for general population / uncontrolled exposure):

Frequency Range (MHz)	Electric Field Strength (E) (V/m)	Magnetic Field Strength (H) (A/m)	Power Density (S) (mW/ cm^2)	Averaging Time $\|E\|^2$,$\|H\|^2$ or S (minutes)
0.3-1.34	614	1.63	*(100)	<30
1.34-30	824/f	2.19/f	*(180/f^2)	<30
30-300	27.5	0.073	0.2	<30
300-1500	-	-	f/1500	<30
1500-100,000	-	-	1.0	<30

Note: f = frequency in MHz; *Plane-wave equivalent power density

ISED Limits (for general population / uncontrolled exposure):

Frequency Range (MHz)	Electric Field (V/m rms)	Magnetic Field (A/m rms)	Power Density (W/ m²)	Reference Period (minutes)
0.003-10^{21}	83	90	-	Instantaneous*
0.1-10	-	$0.73/f$	-	6**
1.1-10	$87/f^{0.5}$	-	-	6**
10-20	27.46	0.0728	2	6
20-48	$58.07/f^{0.25}$	$0.1540/f^{0.25}$	$8.944/f^{0.5}$	6
48-300	22.06	0.05852	1.291	6
300-6000	$3.142f^{0.3417}$	$0.008335f^{0.3417}$	$0.02619f^{0.6834}$	6
6000-15000	61.4	0.163	10	6
15000-150000	61.4	0.163	10	$616000/f^{1.2}$
150000-300000	$0.158f^{0.5}$	$4.21 \times 10^{-4}f^{0.5}$	$6.67 \times 10^{-5}f$	$616000/f^{1.2}$

Note: f is frequency in MHz.
*Based on nerve stimulation (NS).
** Based on specific absorption rate (SAR).

Results:

LTE (HL7810 module with Taoglas PCS.66.A antenna):

LTE Band	Freq. min. (MHz)	Freq. max. (MHz)	Max Conducted Power (dBm)	Radio Power (mW)	Antenna Gain (dBi)	Power Density @ 20cm (mW/cm^2)	Limit (mW/cm^2)	PASS/FAIL
2	1850	1910	24.5	281.84	3.2	0.117	1.000	PASS
4	1710	1755	24.5	281.84	3.2	0.117	1.000	PASS
5	824	849	24.5	281.84	1.3	0.076	0.549	PASS
12	699	716	24.5	281.84	1.3	0.076	0.466	PASS
13	777	787	24.5	281.84	1.3	0.076	0.518	PASS
25	1850	1915	24.5	281.84	3.2	0.117	1.000	PASS
66	1710	1780	24.5	281.84	3.2	0.117	1.000	PASS

ESP32 (from module MPE report, FCC ID: 2AC7Z-ESPS3WROOM1, IC: 21098-ESPS3WROOM1)

Band	Freq. min. (MHz)	Freq. max. (MHz)	Max conducted Power (dBm)	Radio Power (mW)	Antenna Gain (dBi)	Max ERP (mw	Power Density @ 20cm (mW/cm^2)	Limit (mW/cm^2)	PASS/FAIL

WiFi	2400	2500	20.5	112.20	3.26	3.26	.047	1.000	PASS
BLE	2400	2500	10	10	3.26	3.26	.004	1.000	PASS

Colocation:

Per technical description, WiFi and LTE will never co-exist in this product.

Adding BLE power spectral density of 0.004 mW/cm^2 to all LTE bands still results in a passing result.

LTE Band	Power Density @ 20cm (mW/cm^2)	Collocated Power Density @ 20cm (mW/cm^2)	2.4GHz Limit (mW/cm^2)	PASS/FAIL
2	0.117	0.121	1.000	PASS
4	0.117	0.121	1.000	PASS
5	0.076	0.080	1.000	PASS
12	0.076	0.080	1.000	PASS
13	0.076	0.080	1.000	PASS
25	0.117	0.121	1.000	PASS
66	0.117	0.121	1.000	PASS